M/035/015

INTEROFFICE MEMO

To: Wayne Hedberg, DOGM

From: Ed Hickey, DWQ EPH

Date: May 14, 2001

Subject: Kennecott Tailings Impoundment Operations Monitoring Report for 2000
Ground Water Discharge Permit UGW350011

Hi Wayne,

Dennis Frederick asked me to review the 2000 report and write a summary for our permit file. He also asked me to send a copy to DOGM, so here it is for you to file in an appropriate place.

If anyone has any questions or comments, please call.

FILE MEMORANDUM

TO: UGW350011 Kennecott Tailings Impoundment

THROUGH: Dennis Frederick, Manager
Ground Water Protection Section

FROM: Ed Hickey, Environmental Scientist EPA

DATE: April 9, 2001

SUBJECT: Tailings Impoundment Annual Operational Monitoring Report

Introduction

In addition to the sampling of ground water in perimeter monitoring wells, Part I Section 2 of the Tailings Impoundment Ground Water Discharge Permit calls for KUCC to do operational monitoring to assure inflows and interstitial waters are consistent with the approved BAT performance standards for this permit. This has been a permit compliance item since 1995, and was also carried over in the January 2001 permit renewal.

The following materials are subject to semi-annual collection and analysis:

a) Tailings Waters - Kennecott shall characterize the **quality of tailings waters** by monitoring interstitial waters (within the Tailings), water from the top of the impoundment, and other outflows such as seeps in accordance with the Compliance and Operational Monitoring Plan incorporated as Appendix B of the permit.

b) Monitoring of Inflows - Each **solids inflow** to the Tailings Impoundment listed in Section I Part E except solid waste such as Construction, maintenance and lunch room trash, shall be characterized using at a minimum the Synthetic Precipitation Leaching Procedure (SPLP) (EPA SW846 Method 1312) and total metals analysis. The details for monitoring of inflows are described in the Compliance and Operational Monitoring Plan (Appendix B).

c) Acid-Base Accounting - Kennecott shall perform ongoing monitoring of **tailings materials inflow for acid generation potential.** These characterizations shall be performed in accordance with the Assessment of Acidification Potential Plan (Appendix A) of the permit.

2000 Annual Operational Monitoring Report synopsis

Item a) is submitted semi-annually in separate reports, and is reiterated here. Items b) and c) are the important parts of the Operational Monitoring Report. The intent of the permit on these items is to have KUCC collect information on solids and waters that may or may not impact the environment, and in a timely manner so that information is known before it is found in subsurface monitoring wells.

Following is a brief synopsis of the 2000 report.

Tailings Waters: No significant changes in the nature of ground water, seeps, or tailings pore waters. All of the waters have differing chemical compositions and it should be possible to see the effects of changing composition through routine monitoring.

Clarification Canal Return flow waters from the tailings impoundment has been impacted in elevated sulfate, TDS and arsenic since leach water was put into the tailings line starting in 1998. TDS and dissolved arsenic have decreased in 2000. Any effects from these elevated levels in clarification canal waters have not been seen in adjacent shallow aquifer monitoring wells.

Lysimeters are interesting because they can be predictors of the acid generating potential of oxidized embankment material. The lysimeters (on the Magna tailings impoundment in test cells) that have gone acidic are analogs of what to watch for in ground water monitoring wells and surface waters, such as increasing sulfate to chloride ratio or large changes in cations. pH alone does not tell the whole story.

Acidification Potential ABA analyses were performed on samples of Copperton tailings, Magna tailings, Cyclone underflow and overflow material, Single Point Discharge tailings, and smelter slag tailings. No significant change in acid potential between 1999 and 2000 but the neutralization potential was slightly lower. Kennecott still reports an available excess of neutralization potential in the tailings material.

Humidity cells: KUCC completed one more year of humidity cell tests. As in previous years, the material in the cells did not generate acid (as evidenced by dropping pH). Some of the tests do show a decline in alkalinity as the test progressed, thus neutralization capacity was being affected. KUCC will be switching to Net Acid Generation (NAG) testing in the future, we'll try that and see how it goes.

Tailings Inflow SPLP and Total Metals Copperton tailings, Magna tailings, Single Point Discharge tailings, smelter slag tailings, and power plant fly ash are subjected to total metals and SPLP analyses twice per year. DWQ does not have any permit limits for metals or leachate levels, this testing just indicates the character of materials going to the impoundment. Total metals for all materials except smelter slag tailings were below SCDM soil pathway benchmarks. Some materials are SPLP leachable, others are not..

Recent Changes in Report Format

- Decreased the frequency of ground water sampling from quarterly to semi-annual. There is sufficient history in wells surrounding the Tailings Impoundment, and more frequent monitoring is not adding any useful information. The ground water character is not changing much.

- Stopped humidity cell testing because it was not working, and instituted NAG testing at the request of KUCC.

- Changed the format of future reports by not requiring complete analytical history of each monitoring point. This saves 75% of the volume in paper, but may take the long term perspective out of the information. Still, all the data is available in DWQ files and the history

of any particular sampling point can be easily put together. Or KUCC will provide it upon request.

Is the report useful?
Yes, the report provides hard copy support to DWQ oversight of Tailings Impoundment operations. We can readily demonstrate compliance, have data available for public review, and perhaps make predictions of future trends.

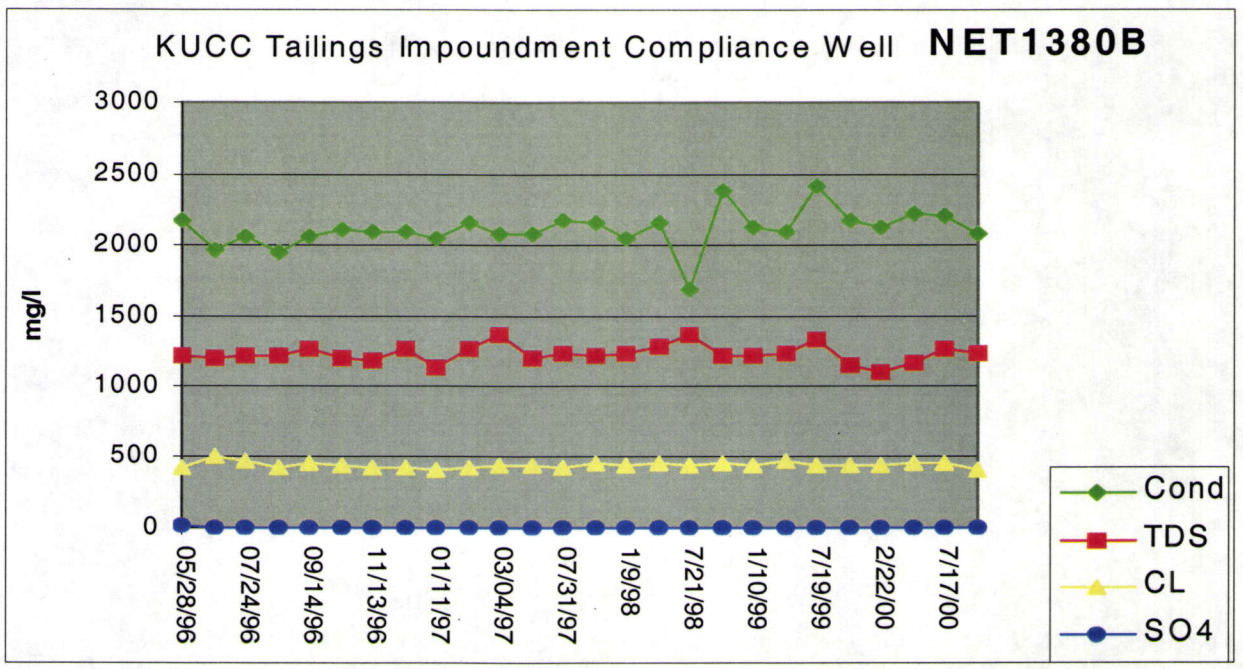
The synopsis section written by the Kennecott Environmental Group usually provides insight into increasing/decreasing trends they have found. For example, if sulfate increases in the clarification canal waters, KUCC looks at the tailings materials or change in processes that may have caused them.

What does the DWQ permit writer do with the information besides store it on the file room shelf?
If one just looks at the past year's data, it is difficult to see trends or anomalies. I have Excel spreadsheets of all the historic water quality information on all water sampling locations that are required by permit. The source is past electronic data dumps supplied by Kennecott, and quarterly or semi-annual data is input when KUCC submits the reports. I do not keep current spreadsheets of the solids material SPLP or ABA results. Historic data back to about 1992 is available from hard copy in DWQ files or can be obtained in an electronic format from KUCC by requesting it.

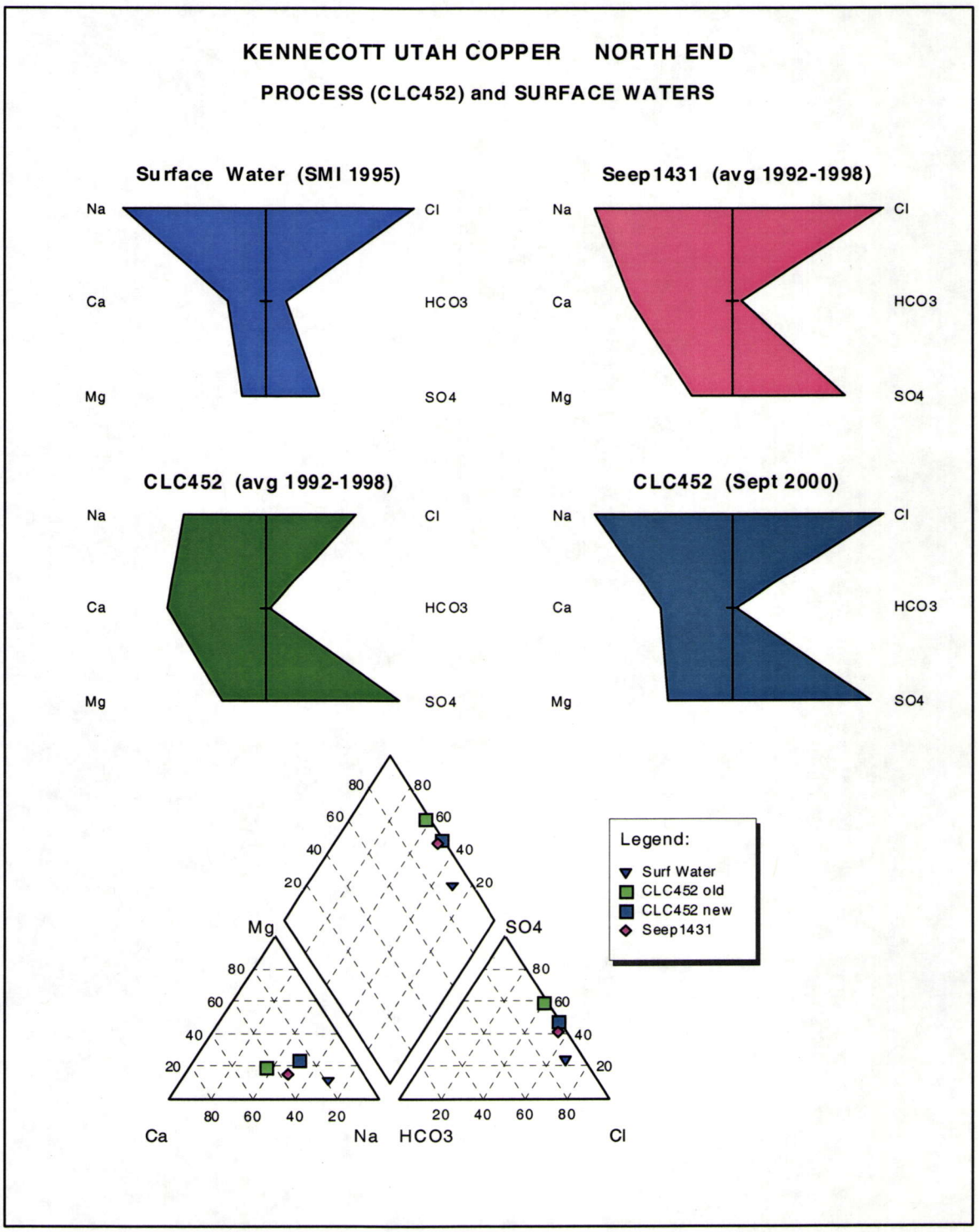
I have found that interstitial waters, process return waters, and aquifer waters are all slightly different in chemical nature. This is apparent in the cation/anion chemistry. Tailings waters are not showing up in the perimeter monitoring wells, at least not yet.

Examples of what DWQ does that KUCC does not provide (they were not asked to):

Graphs of historical monitoring:

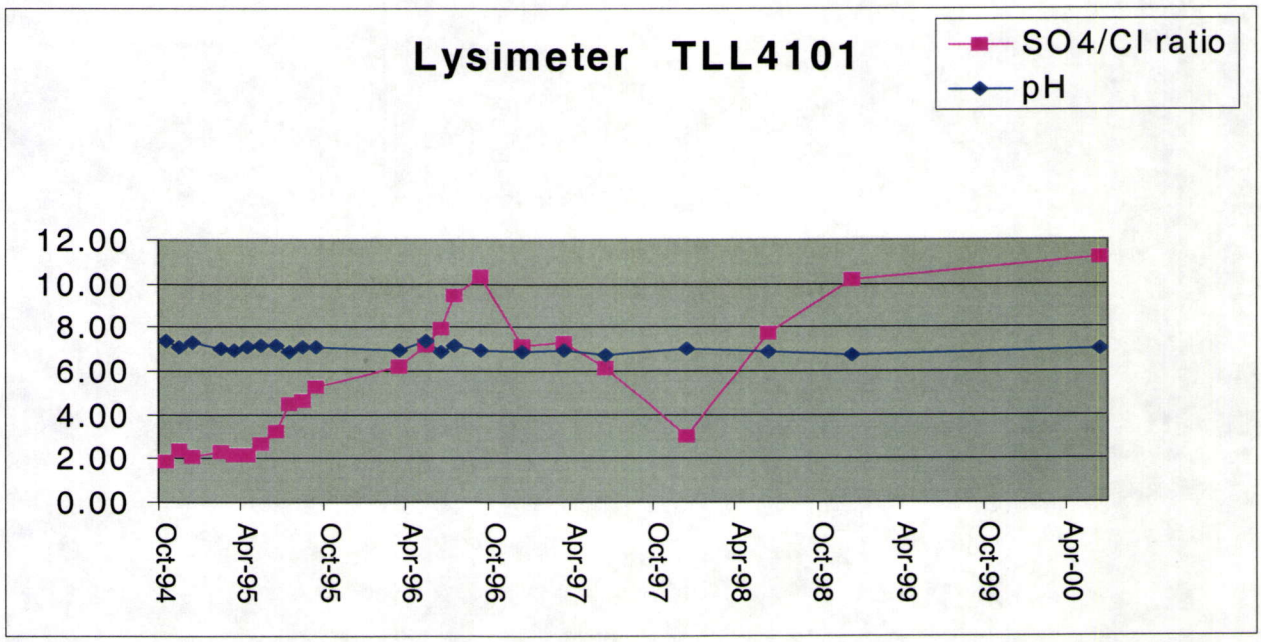


Piper/Stiff diagrams of surface water, ground water, tailings pore water. These compare geochemical signatures of different waters

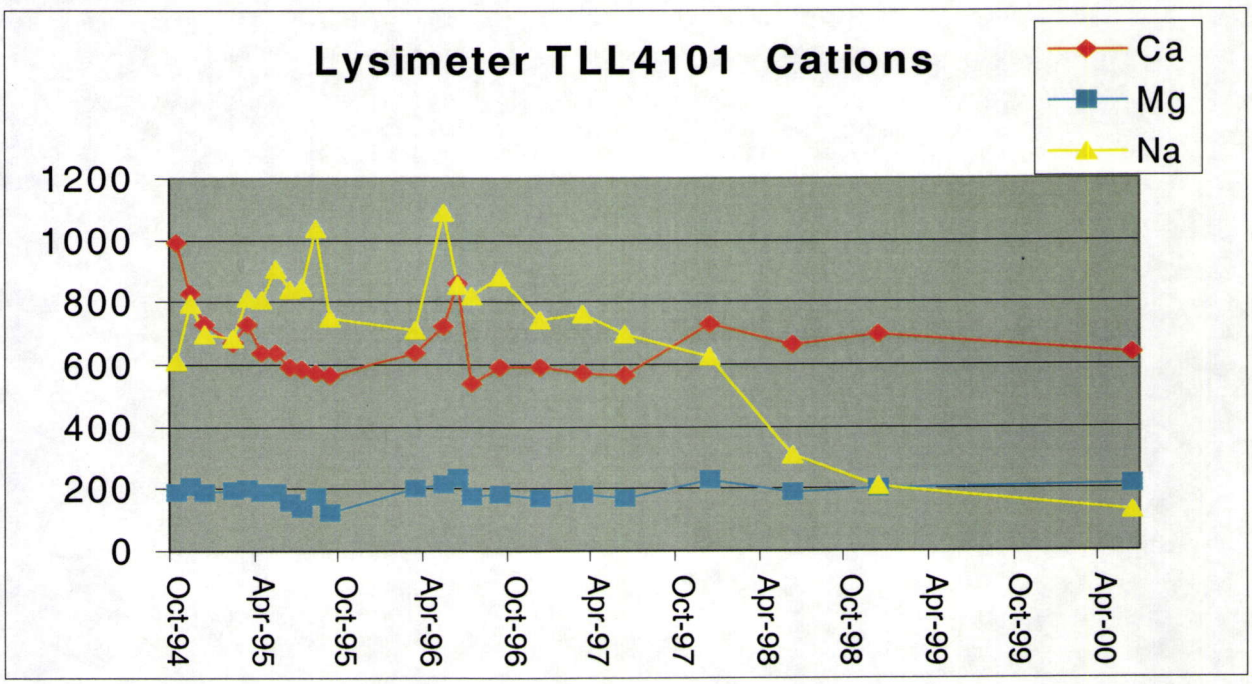


E. HICKEY 1/02/01

Look for diagnostic trends in the data:



Lysimeter showing development of acid water in vadose zone. pH has not dropped significantly yet but the sulfate to chloride ratio indicates sulfate (and therefore sulfuric acid) are generating in place.



Same lysimeter and dates. Cations may fluctuate as composition of pore waters change during acid development